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An American National Standard

Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components[1]

This standard is issued under the fixed designation D 3138; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification provides general requirements for solvent cements used in joining acrylonitrile-butadiene-styrene (ABS) plastic pipe or fittings to poly(vinyl chloride) (PVC) plastic pipe or fittings.

1.2 These cements are intended for use in cementing transition joints between ABS and PVC materials in non-pressure applications only (25 psi (170 kPa) or less).

NOTE 1—This specification was developed to provide a means for joining an ABS non-pressure piping system using a solvent-cemented transition joint, for example, joining ABS building drain to a PVC sewer system. The intention was not to create a specification for an all purpose ABS-PVC solvent cement that would be used for mixing of ABS and PVC piping materials nor to specify a cement that could generally be used for either material. Specific cements for ABS or PVC components should be used (see 1.3).

1.3 Solvent cements used for joining PVC pipe and fittings are specified in Specification D 2564. Solvent cements used for joining ABS pipe and fittings are specified in Specification D 2235.

1.4 A recommended procedure for joining ABS to PVC pipe and fittings for non-pressure applications is given in the appendix.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 The following safety hazards caveat pertains only to the test methods portion, Section 6, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1084 Test Methods for Viscosity of Adhesives[2]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds[3]

D 2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings[4]

D 2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems[4]

D 2661 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings[4]

D 2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings[4]

F 402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings[4]

F 412 Terminology Relating to Plastic Piping Systems[4]

F 493 Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings[4]

3. Terminology

3.1 *Definitions:* Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

4. Materials and Manufacture

4.1 The solvent cement shall be a solution of Class 12454-B, unplasticized poly(vinyl chloride) molding or extrusion compound as classified in Specification D 1784, or equivalent PVC resin.

4.2 Either virgin or clean rework material may be used, provided that the rework material is generated from the solvent

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[2] *Annual Book of ASTM Standards*, Vol 15.06.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 08.04.

cement manufacturer's own production, is compatible with virgin material, and will produce a cement that meets the requirements of this specification.

4.3 The cement shall be free-flowing and shall not contain lumps, macroscopic undissolved particles, or any foreign matter that will adversely affect the ultimate joint strength or chemical resistance of the cement.

4.4 The cement shall show no gelation. It shall show no stratification or separation that cannot be removed by stirring or shaking.

4.5 Inert fillers may be added, provided the resulting cement meets all requirements of this specification.

4.6 The solvents used in the formulation of this solvent cement shall consist of tetrahydrofuran (THF) in combination with cyclohexanone or methyl ethyl ketone (MEK), or both.

NOTE 2—It is recommended that solvent cements made to this specification not be orange since that color is recommended for use with CPVC solvent cement under Specification F 493.

5. Other Requirements

5.1 *Resin Content*—The PVC resin content shall be 10 % minimum when tested in accordance with 6.1.

5.2 *Dissolution*—The cement shall be capable of dissolving an additional 3 weight % of Class 12454-B, PVC compound or the equivalent PVC resin at 73.4 ± 3.6°F (23 ± 2°C) without evidence of gelation.

5.3 *Viscosity*—The minimum viscosity at room temperature shall be 90 cP (90 mPa·s) when tested in accordance with 6.2.

NOTE 3—Cements approaching the minimum viscosity requirement of this specification generally are not recommended for noninterference-type fit (where a gap exists between the pipe and fitting socket).

5.4 *Lap Shear Strength*—The minimum average lap shear strength when tested in accordance with 6.3.2 shall be 600 psi (4.1 MPa) after a 72-h curing time.

5.5 *Hydrostatic Burst Strength*—The minimum average hydrostatic burst strength when tested in accordance with 6.3.3 shall be 200 psi (1.4 MPa) after a 72-h curing time.

6. Test Methods

6.1 *Solids Content*:

6.1.1 *Apparatus*:

6.1.1.1 *Ointment Tins* (Style No. 12, 1-oz (30-mL), all metal).

6.1.1.2 *Vacuum Oven*.

6.1.1.3 *Analytical Balance*.

6.1.1.4 *Centrifuge*.

6.1.2 *Procedure*:

6.1.2.1 Stir the sample thoroughly with a spatula before weighing (Note 4). Weight 3.0 ± 0.5 g of the sample to the nearest 1 mg into a tared ointment tin. Place the tin into the vacuum oven (Note 5), and heat at 248°F (120°C) for 45 min + 15, −0 min. Discard specimens left in for more than 1 h. The vacuum must be continually in operation to draw off flammable solvents. Absolute pressure should not exceed 15 mm Hg. Remove the tin from the oven and place in a desiccator until cooled to room temperature. Weigh the tin and dried sample to the nearest 1 mg.

NOTE 4—This material is usually nonhomogeneous and shall be thoroughly stirred before weighing. The weighing shall also be accomplished quickly to avoid loss of solvent by volatilization. Some vacuum ovens require a longer period of time than 15 min to reach 120°C, even after preheating. It is recommended that the operator watch closely the time required to reach 120°C and, by manipulation of the heat control mechanism, minimize the amount of time required to reach 120°C while not exceeding the required temperature.

NOTE 5—The use of a vacuum oven is mandatory for drying the specimen. This oven has neither an exposed heating surface nor an open flame, thus avoiding the danger of flashing. The oven also provides an open vacuum to exhaust solvent fumes.

6.1.2.2 After weighing, dissolve the dried sample in THF and determine quantitatively any inert fillers by means of centrifuging. Deduct the weight of the fillers determined from the weight of the dried sample prior to calculating the content of PVC resin in the cement.

NOTE 6—Dissolve most of the dried sample by adding 15 mL of THF to the sample in the ointment tin and stirring with a glass rod for 15 min. Dissolve the remainder with a second addition of 15 mL of THF, followed by a third addition of 5 mL of THF to rinse the ointment tin. Centrifuge the entire volume at 20 000 r/min for 15 min. Discard the supernatant liquid. Add 15 mL of THF to the tube, mix thoroughly, and transfer the tube contents to the ointment tin. Use 2 mL more of THF to wash down the tube, and pour into the ointment tin. Evaporate off the THF in the vacuum oven at 248°F (120°C) for 45 min. Cool in desiccator, weigh the tin to the nearest 1 mg, and calculate the percent of inert filler present in the cement.

6.1.3 *Calculation*—Calculate the percentage of PVC resin, *R*, as follows:

$$R, \% = [(B - A - D)/(C - A)] \times 100$$

where:

A = weight of ointment tin,
B = weight of tin and specimen after drying,
C = weight of tin and specimen before drying, and
D = weight of inert filler, if present.

6.2 *Viscosity*—Measure the viscosity in accordance with Method B of Test Methods D 1084 except that conditioning to temperature equilibrium only is required. For qualification purposes use a Model RVF viscometer, a speed of 10 r/min, and the spindle that, by trial, gives the closest reading to center range of scale for the cement being tested. Other speeds may be used for quality control purposes.

6.3 *Bond Strength*:

6.3.1 *Number of Specimens*—A minimum of five specimens shall be tested for each requirement of 5.4 and 5.5.

6.3.2 *Lap Shear Strength*:

6.3.2.1 Each test specimen (Fig. 1) shall consist of a 1 by 1-in. (25 by 25-mm) section cut from a ¼-in. (6-mm) thick Type I rigid ABS sheet and a 1 by 2-in. (25 by 50-mm) section cut from a ¼-in. (6-mm) thick Type I rigid PVC sheet.

6.3.2.2 Clean the surfaces to be adhered with a cloth dampened with methyl ethyl ketone (MEK).

6.3.2.3 Using a 1-in. (25-mm) natural bristle brush, apply a thin layer of cement to the complete surface of a 1 by 1-in. (25 by 25-mm) sheet section and to the center of a 1 by 2-in. (25 by 50-mm) sheet section.

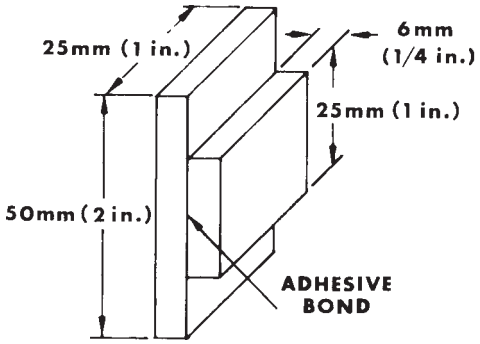

FIG. 1 Compressive Shear Specimen

6.3.2.4 Assemble these sections immediately and rotate the 1 by 1-in. (25 by 25-mm) section 180° on the 1 by 2-in. (25 by 50-mm) section, within 5 s, using light hand pressure (approximately 0.5 lbf (2 N)).

6.3.2.5 Place the assembled test specimen on a clean, level surface using the 1 by 2-in. (25 by 50-mm) section as a base. After 30 s, place a 4.4-lb (2-kg) weight on the test specimen for a period of 3 min, and then remove.

6.3.2.6 Store the assembled test specimens at 73.4 ± 3.6°F (23 ± 2°C) for the specified time and test immediately in a holding fixture similar to that shown in Fig. 2. The shear speed shall be 0.05 in. (1.25 mm)/min. Express the results in pounds per square inch (or megapascals).

6.3.3 *Hydrostatic Burst Strength*:

6.3.3.1 Use nominal 2-in. PVC pipe meeting the requirements of Specification D 2665 and 2-in. ABS couplings meeting the requirements of Specification D 2661.

6.3.3.2 Cut the pipe square into 6-in. (152-mm) lengths.

6.3.3.3 Deburr the pipe and clean the pipe and fitting with a clean dry rag.

6.3.3.4 Check the dry fit of the pipe into the coupling socket for interference fit. The fit shall be such that the pipe will enter the socket from ⅓ to ⅔ of the socket depth dry when assembled by hand.

6.3.3.5 Dip a 1-in. brush into MEK and apply a uniform coating of MEK on the PVC pipe. Allow to set 30 s.

6.3.3.6 Immediately flow on a uniform liberal coat of cement on the PVC pipe with a 1-in. bristle brush.

6.3.3.7 Apply a uniform light coat of cement to the ABS coupling.

6.3.3.8 Apply a second uniform layer of cement to the pipe.

6.3.3.9 Assemble immediately while joining surfaces are wet. Hold joint together for 1 min for initial set and wipe off bead of cement at juncture of pipe and fitting.

6.3.3.10 Store the cemented specimens at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for 72 h and test immediately.

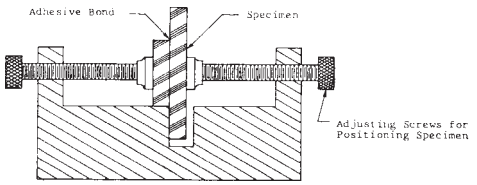

FIG. 2 Typical Specimen Holding Fixture

6.3.3.11 Increase the internal hydrostatic pressure at the rate of 200 psi (1.4 MPa) ± 10 % until failure occurs.

7. Retest and Rejection

7.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in the specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

8. Report

8.1 Report the following information:

8.1.1 Name of cement manufacturer,

8.1.2 Lot number,

8.1.3 Total PVC resin, −0/0W,

8.1.4 Dissolution, pass or fail,

8.1.5 Viscosity,

8.1.6 Average lap shear strength at each cure time and complete identification of PVC and ABS sheet stock used in the tests,

8.1.7 Average hydrostatic burst strength, and

8.1.8 Total inert filler, −0/0W.

9. Certification

9.1 When specified in the purchase order, the manufacturer shall certify to the purchaser or to his nominee that the products in the specified lots meet all the requirements of this specification and, when requested, shall include a copy of the manufacturer's routine quality control tests results to document that the specification requirements have been met. Each certification so furnished shall be signed by an authorized agent of the manufacturer.

10. Container Labeling and Marking

10.1 Container labeling of cement shall include the following:

10.1.1 Manufacturer's or supplier's name and address and tradename or trademark.

10.1.2 This designation: ASTM D 3138.

10.1.3 Function of material; for use on transition joints between ABS and PVC non-pressure systems (examples: building drain to building sewer, building sewer to main sewer).

10.1.4 Procedure or instructions for application of the cement.

10.1.5 Lot number of batch on container (not on closure or lid.)

10.1.6 All warnings and cautions necessitated by:

10.1.6.1 Ingredients,

10.1.6.2 Handling and distribution of the product,

10.1.6.3 Intended use of the product, and

10.1.6.4 Requirements of law (such as the Federal Hazardous Substance Act). These are intended to warn those who handle or use the product against potential hazards, such as flammability, toxicity, etc.

NOTE 7—It is recommended that the color of the contents be indicated on the label.

11. Safe Handling of Solvent Cement

11.1 Solvent cements for plastic pipe are made from flammable liquids and should be kept away from all sources of ignition. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

11.2 Refer to Practice F 402 for additional information.

12. Quality Assurance

12.1 When the product is marked with this designation, D 3138, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

APPENDIX

(Nonmandatory Information)

X1. RECOMMENDED PROCEDURE FOR JOINING ABS TO PVC PIPE OR FITTINGS WITH ABS-PVC NON-PRESSURE SOLVENT CEMENT

X1.1 *Cutting the Pipe*—Cut the pipe using a fine-tooth hand saw and a mitre box or a fine-toothed power saw with a suitable guide. A rotary cutter may be used if the cutting blades are specially designed for cutting plastic in such a way as not to raise a burr or ridge (flare) at the cut end of the pipe. Remove all burrs with a knife, file, or abrasive paper.

X1.2 *Test Fitting*—Wipe both the outside of the pipe and the fitting socket with a clean dry cloth to remove moisture and foreign matter. Mate the two parts without forcing. The pipe should enter the socket one quarter to three quarters of the socket depth. Very tight fits (pipe will not enter socket without forcing) and loose fits (pipe bottoms easily in socket with slop) are to be avoided.

X1.3 *Joint Preparation*—Surfaces to be joined should be clean and free of moisture before application of the cement. Remove the gloss from the surface of the PVC part to be joined with a cleaner or primer recommended by the cement manufacturer. It is generally not necessary to prime the ABS surface.

X1.4 *Applying the Cement*—Apply the cement with a 1-in. brush for pipe sizes up to 2-in. and a brush width at least one half of the pipe diameter for the larger size pipe. Other applicators may be used effectively provided their use results in an equivalent amount of cement applied to the joining surfaces.

X1.4.1 *For Joining PVC Pipe to an ABS Fitting*—First apply a uniform moderate coat of cement to the PVC pipe to the depth of the fitting socket. Next, apply a uniform light coating of cement to the ABS socket. Avoid puddling of cement in socket. Re-coat the PVC pipe with a second uniform coat of cement.

X1.4.2 *For Joining ABS Pipe to PVC Fitting*—First apply a uniform light coat of cement to the PVC socket, and avoid puddling of cement in socket. Next, apply a uniform moderate coat of cement to the ABS pipe. Re-coat the PVC socket with a second uniform light coat of cement.

X1.5 *Assembly of Joint*—Immediately after applying the last coat of cement, insert the pipe into the fitting until it bottoms. If possible, turn the pipe during assembly one quarter of a turn (but not after the pipe is bottomed) to evenly distribute the cement. If there are signs of drying of the cement surfaces, due to delay in assembly, the surfaces should be re-coated, taking care again to avoid puddling of cement in the socket. Hold the pipe and fitting in place for approximately 1 min to keep the pipe from backing out of the socket. Wipe excess cement from the pipe at the end of the socket with a clean dry cloth. Allow the joint to set for approximately 15 min to develop good handling strength, longer periods are necessary in cold weather, below 60°F (15.6°C).

X1.6 *Cure Time*—Follow solvent cement manufacturer's recommendations for cure time.